Metals Review

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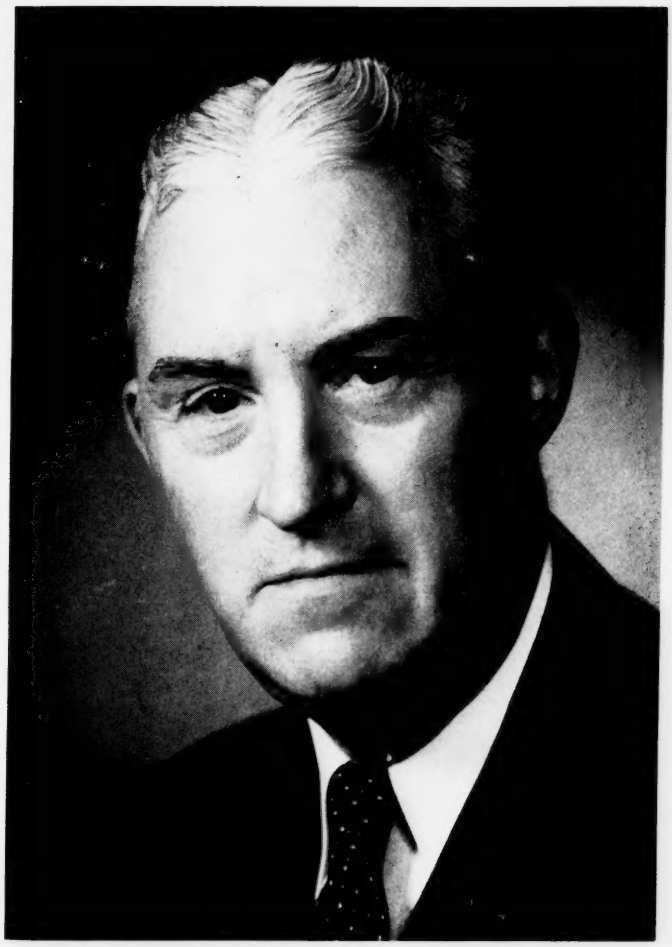
Published by the American Society for Metals

February 1960



Ralph Wilson
A.S.M. Past President
(See Article, p. 5)

(A.S.M. PREPRINT PAPERS—p. 6)

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Metals Review

The News Digest Magazine

February, 1960
Vol. XXXIII, No. 2

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Technical Council Formed to Help A. S. M. Meet Demands of Increased Responsibility

As a major step in preparing the Society for its role in a vastly expanding metalworking industry, the A.S.M. Board of Trustees has established a new Technical Council. In creating the council, which will co-ordinate activities of all present and future technical committees of the Society, the Board stated objectives in the following terms:

"The purpose of the Technical Council is to foster the technical objectives of the Society by supervising and co-ordinating the activities of committees appointed to initiate and help implement the technical activities of the Society. The Council is to be concerned with programs, publications, technical development and chapter activities. It is to recommend to the Board of Trustees (1) the creation of new committees whenever new activities make this action desirable, (2) the dissolution of committees no longer needed and (3) changes in membership or scope of activities of existing committees whenever such changes are necessary for the advancement of the Society's interests."

An underlying philosophy which led to the formation of the council was recognition of the need to undertake steps to provide long-range planning so the Society can offer maximum service to the maximum number of members. It was the Board's opinion that this objective could best be met by calling upon the active participation, through committee work, of many more members of the Society than has been possible in the past. The Council will balance staff and committee responsibilities in the operation of the Society and thus add greatly to the total activities and services that the Society makes available to the metal economy.

One immediate benefit to be derived from the Technical Council is an interchange of information between technical committees of the Society. The objective will be met at least in part through representation by Technical Council members on all technical committees.

Present committees of the Society which become the responsibility of the Technical Council are:

Seminar Committee

Metals Engineering Program Committee

Metals Handbook Committee

Metal Progress Editorial Advisory Committee

Transactions Committee

Metallurgical Documentation Committee

Advisory Committee on Metallurgical Education

Career Development Committee

Chapter Advisory Committee

Each of the committees listed will have the necessary staff co-operation in the areas of: program and meeting execution; editing and publications; educational functions; membership and chapter activities; and implementation and liaison.

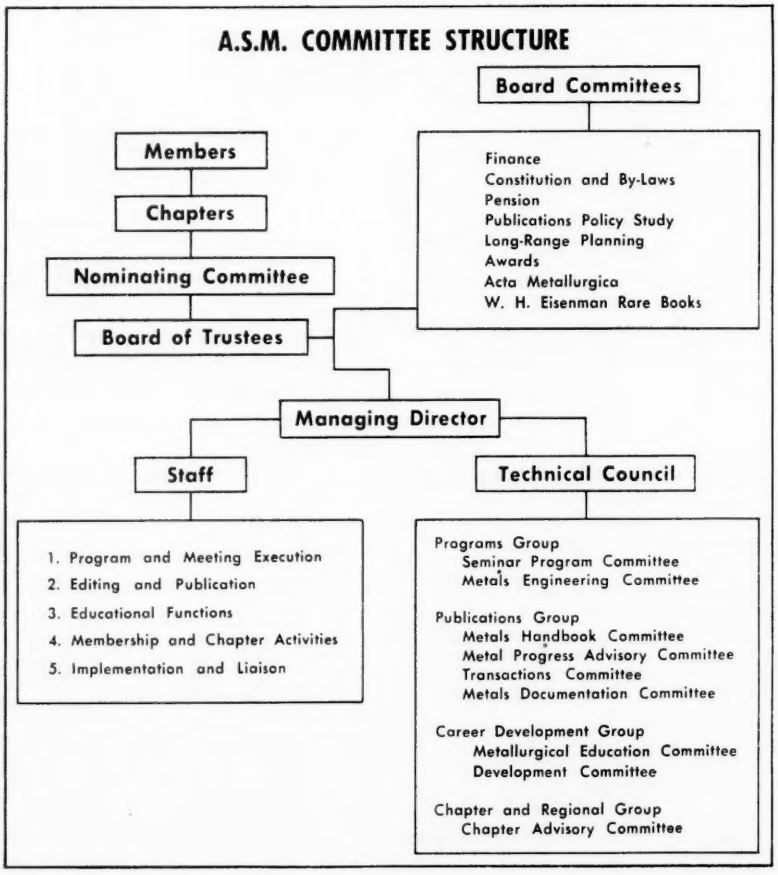
In explaining the Technical Council and its responsibilities, A.S.M.'s president, Walter Crafts, stated that one major goal of the council is to serve the needs of the entire metalworking industry rather than to serve the specialized needs of a few segments. The Council will provide opportunity for each member of the Society to offer aid and assistance within his own field of endeavor to every other member who has need for specialized assistance.

Looking to the future, Allan Ray Putnam, A.S.M's managing director, states that one of the richest and most fertile results of the Council's activity is that many more people will be more completely attuned to the needs of the average A.S.M. member. The broader interests of a greatly enlarged membership will benefit from this development and will, in turn, benefit all of industry. Thus, the total needs of all members will be implemented in the best possible way by qualified professional help from qualified professional membership.

Council Membership

The Technical Council consists of a chairman, 12 members, the Society's managing director, and, ex-officio, the Society's vice-president as a representative of the Board of Trustees. Each year four members of the Council will be appointed to three-year terms by the president, by and with the approval of the Board of Trustees. The Council will be asked to recommend new candidates for Council membership each year.

The chairman of the Technical Council automatically becomes an ex-officio member of each of the technical committees with power to delegate such membership to various members of the council. The Council representative on each committee will be responsible for the cir-



A. S. M. Past President to Receive Professional Engineers Award

Another milestone has been reached in the distinguished career of A.S.M. Past President, Ralph L. Wilson. He has been chosen to receive the highest award of the Ohio Society of Professional Engineers.

Saluted as Leader

The citation, to be presented Mar. 26 at the O.S.P.E. State Convention Banquet in Cincinnati, salutes Mr. Wilson as a world-wide leader in the development of quality alloy steels for the antifriction bearing industry. He is also cited for his contribution to the engineering profession for doing so much to raise the status of the professional engineer in industry.

Background with A.S.M.

Director of metallurgy for Timken Roller Bearing Co., Canton, Mr. Wilson began a long and active association with the American Society for Metals as chairman of the Society's Canton-Massillon Chapter in 1931. Then, after serving as national trustee, national treasurer and national vice-president, he was elected national president of A.S.M for 1952-1953. He later became chairman of the $700,000 A.S.M. Foundation for Education and Research.

After graduating from Lehigh University in 1921 with a degree in electrometallurgy, he entered industry with the United Alloy Steel Corp., Canton, as a metallurgist. From 1926 to 1928 he was a member of the metallurgical staff of Central Alloy Steel Co., Massillon.

His first position with Timken was that of assistant metallurgist, which he assumed in 1928, becoming metallurgical engineer for the Steel and Tube Division in 1933. He left Timken in 1937 to join the staff of Climax Molybdenum Co.

Work with the Government

During the Second World War Mr. Wilson served as chief of the Constructional Section, Metallurgical Branch, Steel Division, War Production Board (1942-1944). He was also a member of the Industry Advisory Committee on Superalloys, and leader on Superalloys for the Metallurgical and Operations Committee.

From 1948 to 1953 he was a member of the Panel on Metallurgy, Committee on Basic Physical Sciences, Research and Development Board, National Military Establishment and of the Panel on Metals and Minerals, Research and Development Board, for the Department of Defense. He served in the Business and Defense Services Executive Reserve of the Department of Commerce from 1956 to 1959.

He rejoined Timken Roller Bearing Co. in 1944 as chief metallurgical engineer, becoming director of metallurgy in 1946.

Professional Affiliation

In addition to the American Society for Metals, Mr. Wilson belongs to the American Society for Testing Materials, American Petroleum Institute, American Welding Society, American Ordnance Association, American Society of Mechanical Engineers and the American Association for the Advancement of Science.

Mr. Wilson's professional career has encompassed almost the entire period of development of the alloy steel industry as we know it today. During this time he has played an important part in the development of many steel compositions, manufacturing processes and methods as well as testing and specification procedures.

Pioneer in Industry

He was one of a small group which pioneered the engineering development of steel compositions for such elevated temperature applications as steam turbines, pressure vessels and seamless tubing for high temperature, high pressure and corrosive elements.

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	Term	Chapter
G. A. Fisher (Chairman)	1960	St. Louis
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A. Bornemann	1962	New Jersey

W. A. Pennington (Vice-President A.S.M., Ex-Officio)

A. R. Putnam (A.S.M. Managing Director)

culation of reports of other committees without impairing the autonomy of these individual committees. His function is to assist in liaison and co-ordination between technical committees. The Council will serve to stimulate and inspire without restricting the activities of individual committees. Functioning in this manner, the Council will assure each committee having direction without dictation.

Recommendations and reports of the technical committees will be acted upon by the Council and its recommendations communicated to the managing director.

MAKE A DATE
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Second Southwestern Metal Exposition and Congress Will be Held in

Dallas . . .

May 9-13, 1960

ASM TRANSACTIONS PAPERS PREPRINT LIST

Orders must reach A.S.M. Headquarters by Mar. 15, 1960 (Use Coupon, p. 7)

All of the following papers accepted by the A.S.M. Transactions Committee will be preprinted for distribution to members of the American Society for Metals upon request. All papers will subsequently be published in A.S.M. Transactions.

Orders for preprints should reach A.S.M. headquarters by Mar. 15. Please use the coupon on p. 7 and order by number. Preprints will only be available in limited quantities so send your order promptly.

178. **Phase Equilibria and Properties of Yttrium-Titanium Alloys,** by D. W. Bare and O. N. Carlson, Institute for Atomic Research, Iowa State College, Ames, Iowa.

179. **Columbium-Carbon System,** by Rodney P. Elliott, Research Metallurgist, Metals Research Dept., Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.

180. **Effect of Low Alloy Additions on the Properties of Uranium,** by W. H. Friske, H. E. Kline and M. H. Binstock, Fuel Element Development, Atomics International, Canoga Park, Calif.

181. **Beta Transformation Characteristics of Titanium Alloyed With Vanadium and Aluminum,** by E. L. Harmon, Metals Research Laboratories, Electro Metallurgical Co., Niagara Falls, N. Y.; and A. R. Troiano, Case Institute of Technology, Cleveland, Ohio.

182. **Influence of Hot Rolling Conditions on Brittle Fracture in Steel Plate,** by F. de Kazinczy, Physical Metallurgist, Oxelosunds Jarnverksaktiebolag, Oxelosund, Sweden; and W. A. Backofen, Associate Professor of Metallurgy, Metals Processing Laboratory, Massachusetts Institute of Technology, Cambridge, Mass.

183. **The Decompoition of Austenite in 4340 Steel During Cooling,** by E. P. Klier, The Catholic University of America, Washington, D. C.; and T. H. Yeh, International Business Machines Corp., Poughkeepsie, N. Y.

184. **The Ternary System Cadmium-Bismuth-Indium,** by E. A. Peretti, Dept. of Metallurgical Engineering, University of Notre Dame, Ind.

185. **Effect of Decarburization and Grinding Conditions on Fatigue Strength of 5% Cr-Mo-V Sheet Steel,** by E. A. Simkovich, Republic Aviation Corp., Farmingdale, L. I., N. Y.; and E. A. Loria, Climax Molybdenum Co., Pittsburgh, Pa.

186. **Activation Energies for Basal Slip in Magnesium Single Crystals,** by T. A. Trozera, J. Mote and J. E. Dorn, Dept. of Engineering, Institute of Engineering Research, University of California, Berkeley.

187. **The Systems Y-Fe, Y-Ni and Y-Cu,** by R. F. Domagala, J. J. Rausch and D. W. Levinson, Armour Research Foundation of Illinois Institute of Technology, Metals Research Dept., Chicago, Ill.

188. **On the Hardenability Effect of Boron in Steel,** by R. A. Grange and J. B. Mitchell, Edgar C. Bain Laboratory for Fundamental Research, U. S. Steel Corp., Research Center, Monroeville, Pa.

189. **Size, Manganese Content and Curie Point of Carbides Extracted From Manganese Steel,** by R. W. Gurry, Union Steel Corp., Union, N. J.; J. Christakos, Esso Research Laboratories, Linden, N. J.; and L. S. Darken, Edgar C. Bain Laboratory for Fundamental Research, U. S. Steel Corp., Monroeville, Pa.

190. **Heats of Formation of Iron-Manganese Alloys,** by W. B. Kendall and Ralph Hultgren, Institute of Engineering Research, University of California, Berkeley.

191. **High-Temperature Heat Contents of Some Binary Iron Alloys,** by W. B. Kendall and Ralph Hultgren, Institute of Engineering Research, University of California, Berkeley.

192. **The Constitution of Rhenium-Columbium Alloys,** by P. Levesque, W. R. Bekebrede and H. A. Brown, Raytheon Manufacturing Co., Research Div., Waltham, Mass.

193. **Self-Diffusion in Nickel Single Crystals,** by A. Messner, R. Benson and J. E. Dorn, Institute of Engineering Research, University of California, Berkeley.

194. **The Effect of Phosphorous on the Elevated Temperature Strength and Weldability of Some Low Carbon Austenitic Stainless Steels,** by G. R. Rundell, Crucible Steel Co. of America, Pittsburgh, Pa., and R. J. Raudebaugh, The International Nickel Co., Inc., New York, N. Y.

195. **Liquid Metal Fuel Constitution. Pt. 1. The Solubility of Uranium in Bismuth,** by Donald G. Schweitzer and John R. Weeks, Brookhaven National Laboratory, Upton, L. I., N. Y.

196. **Liquid Metal Fuel Constitution. Pt. 2. Liquidus Curves of the Uranium-Zirconium-Bismuth System,** by Donald G. Schweitzer and John R. Weeks, Brookhaven National Laboratory, Upton, L. I., N. Y.

197. **Growth Processes in Recrystallization of Aluminum,** by S. Weissmann, Rutgers University, Bureau of Engineering Research, New Brunswick, N. J.

198. **The Relationship Between the Constitution and Mechanical Properties of Titanium-Rich Alloys of Titanium and Cobalt,** by F. W. Yakymyshyn, G. R. Purdy, University of Alberta, Edmonton, Canada; R. Taggart, University of Washington, Seattle, and J. Gordon Parr, University of Alberta, Edmonton, Canada.

(See Coupon for Ordering Preprints, p. 7)

Cites Progress In Continuous Casting

Presentation of a Utah Chapter Beehive Memento to C. A. Zeldin, Center, Kennecott Copper Corp., Who Spoke on "Progress in the Art of Continuous Casting" at a Recent Meeting, Is Made by Chairman J. M. Carrera. Assisting is B. R. MacKay, first vice-chairman and acting technical chairman

Speaker: C. Arthur Zeldin
Kennecott Copper Corp.

Utah Chapter members enjoyed the special honor of being addressed by one of its own Executive Committee officers, C. Arthur Zeldin, superintendent of operations, Utah Refinery, Kennecott Copper Corp., who spoke on "Progress in the Art of Continuous Casting".

Mr. Zeldin reviewed the early history and development of continuous casting, pointing out that the concept of continuous casting is not new, but that only in recent years has this concept been developed on a practical commercial scale. Continuous casting offers many advantages over conventional methods of casting and its application to commercial production in each of the three major metal industries, aluminum, copper and steel, has been determined by problems and difficulties which are unique to the specific metal involved. Consequently, the adoption of continuous casting methods has not progressed at the same rate in all three industries.

Continuous casting has been most successfully applied to the light metals. It is well established in the production of heavy slabs and good progress has been made in the direct casting of rod, strip and sheet.

Mr. Zeldin reported that, although progress in the continuous casting of copper has not been as spectacular as in the aluminum industry, experience with slab and billet casting indicates that the major technical problems have now been solved. Casting of slabs offers a means of tonnage production with a considerable savings in capital investment as well as competitive operating costs. The direct casting of copper rod, strip and sheet must await further development to make its adoption possible.

The progress of continuous casting has been slower in the steel industry than in the nonferrous field as a result of problems inherent to the metal and the industry. The development of an adequate technology for continuously casting the many grades of steel is still in progress. Mr. Zeldin pointed out that continuous casting has its greatest potential for new plants where it has the opportunity of reducing capital investment by replacing the usual combination of ingot casting, soaking pit and blooming mill facilities.

Mr. Zeldin expressed the hope that the steel industry will take note of the development work being done in Western Europe and the Soviet Union. The United States has been a pioneer in developing this process for the steel industry but the major commercial applications have taken place elsewhere. According to Mr. Zeldin, there appears to be no reason why continued development should not solve the remaining problems and give sufficient evidence to convince management that this process is the one of the future for the steel industry just as it is in the nonferrous field.—**Reported by Ralph R. Hitchcock for Utah.**

Speaks at Sacramento

John E. Dorn, professor of metallurgy, University of California, presented a talk entitled "Creep Behavior of Metals" at a meeting held by the **Sacramento Valley Chapter.** He discussed the various mechanisms of creep as identified by experimental approaches such as activation energies and stress laws.—**Reported by Clarke Stanley for Sacramento Valley Chapter.**

Transactions Preprints
American Society for Metals
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Presents Story of the Rare Earths

Bernard Love, Research Chemical Div., Nuclear Corp. of America, Spoke on "16 New Metals—the Rare Earths", at San Fernando Valley. Shown are, from left: Mr. Love; Martin Binstick, chairman; and Joseph Byrne

Speaker: Bernard Love
Research Chemicals Div.
Nuclear Corp. of America

Members of the **San Fernando Valley Chapter** heard Bernard Love, director of research, the Research Chemicals Division, Nuclear Corp. of America, speak on "Sixteen New Metals—the Rare Earths".

Mr. Love's talk concerned the elements of atomic numbers 57 through 71, which include lanthanum, cerium, praseodymium, neodymium, etc., plus yttrium and scandium. He pointed out that promethium, atomic number 61, does not occur naturally but is a fission product. The term "rare earth" is considered a misnomer by Mr. Love since he does not feel that they are rare in the sense that they are unavailable. Mr. Love pointed out, for instance, that the total rare earths are half as abundant as carbon and chlorine and that even the scarcest are more abundant than cadmium, silver and bismuth.

The uses to which the rare earths are being put include the use of mixed oxides and compounds in the glass industry, as core material for searchlights and projection arc lamp electrodes, and the rather common usage of misch metal in pyrophoric alloys. Misch metal has also found use as a deoxidizing agent in cast iron and steels and stainless steels. New commercial magnesium alloys containing several percent rare earths have been developed for use at moderately elevated temperatures.

Mr. Love's talk covered such items as the preparation and purification of the metals from ores and the properties of the pure metals, including their mechanical and physical properties. One interesting phenomenon pointed out was that, although the rare earths are poor conductors of electricity, the specific resistance being generally in the range of 70-140 $\times 10^{-6}$ ohm-cm., resistance anomalies occur at temperatures of magnetic transformation. Most rare earths exhibit a normal decrease in resistivity as a function of pressure. Ytterbium, however, has been found to increase its resistivity by a factor of 12 when the pressure is increased from atmospheric to 860,000 psi. Lanthanum has been found to be superconducting at very low temperatures.

All of the rare earths are paramagnetic, but Mr. Love gave a demonstration with the element gadolinium wherein he demonstrated that this material was ferromagnetic below 16° C., but became nonmagnetic above this temperature.

The potential application for rare earth metals was also discussed. Mr. Love pointed out that the specific gravity of scandium, for instance, is only slightly higher than that of aluminum. Yttrium is almost exactly the same as titanium, etc. The melting points are in about the same range as titanium. The potential for structural materials, either as alloy-base materials or as addition elements to other alloy-base materials is, therefore, deserving of considerable future investigation, particularly in the area of missile and space travel where critical applications will require small quantities of specialized materials. Nonmilitary applications, particularly as alloying additions to improve the properties of processing of more commonly used metals, also seem promising.

Mr. Love believes that in the next few years the air of mystery surrounding the rare earth metals will disappear when the mechanical, magnetic and electrical properties, etc., become better known to metallurgists and fabricators.

This new-found knowledge will undoubtedly result in increased application of these materials in structural and other applications.—**Reported by F. Keith Lampson for San Fernando Valley Chapter.**

MAKE A DATE FOR DALLAS

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Dallas . . .

May 9-13, 1960

Discusses Semiconductor Metallurgy

Fred Rossi, Head, Semiconductor and Metals Research Group, RCA Research Laboratories, Spoke on "The Metallurgy of Semiconductors" at a Rhode Island Meeting. He discussed crystal growth, purification and control of structural defects in elemental and compound semiconductors, solid solution alloying and its effect on semiconductor and thermo-electric properties and semiconductor technology and its importance in a better understanding of structural defects in crystals. Shown are, from left: Marshall C. Battey, chairman; Ralph Carlson, U. S. Weather Bureau, the coffee speaker; Dr. Rossi; and Joseph J. Buchinski, program chairman

Reviews Embrittlement

"Hydrogen Embrittlement Trouble Shooting" Was the Subject Covered by William M. Baldwin, Jr. (Left), Case Institute of Technology, at a Meeting in Rochester. He is shown with Frank Gehrlein, then vice-chairman

Speaker: **William M. Baldwin, Jr.**
Case Institute of Technology

W. M. Baldwin, Jr., presented a talk on "Hydrogen Embrittlement Trouble Shooting" at a meeting in **Rochester.**

Hydrogen embrittlement has been the plague of many industries for years. During World War I, armor piercing shells were placed in safe storage, and after a definite length of time, the shells which did not crack were sent to the battlefront. The same procedure was given the doughboys' helmets. Patented steel wire for cables in bridges also suffered the attack of hydrogen embrittlement; during World War II the landing gears of the heavy bombers collapsed while standing idle on the landing fields.

High hardness gives extreme hydrogen embrittlement. The type of steel and the amount of H_2 in it determines the degree of embrittlement. H_2 in steel seeks equilibrium in the solid steel and in the voids. Rolling increases the size of the voids and then the H_2 seeks the voids, that is, it emigrates from the surrounding solid metal into the voids. The solid metal is depleted of H_2, the voids gain an excess of H_2 and thus embrittlement is created.

Dr. Baldwin discussed AISI 4340 aircraft steel which has an ultimate tensile strength of 230,000 psi., and if it contained 1 part per million of H_2, the result of static fatigue under dead load could be observed after several hours. The steel would break at 70,000 psi. The answer to the World War I problems thus was static fatigue.

In conclusion, the speaker stated that baking at 350 to 375° F. drives H_2 into the steel, some out of the steel, and thus dilutes the concentrated H_2 at the surface and thereby eliminates the embrittlement reaction. Some companies now plate a thickness of 0.00075 in., bake, and then replate to the desired thickness of plate. The thin plate prevents H_2 penetrating the steel and this procedure eliminates serious H_2 embrittlement.

A final note was made that if a part breaks in time, it suggests H_2 embrittlement.—**Reported by Joseph V. Hurley for Rochester.**

Describes PH Stainless

Marc Marshall, Left, Armco Steel Co., Who Presented a Talk Entitled "Precipitation Hardening Stainless Steels" at a Meeting Held by the Cincinnati Chapter, Is Shown With Chairman Pfetzing

Speaker: Marc Marshall
Armco Steel Corp.

Marc Marshall, Armco Steel Corp., spoke on "Precipitation Hardening Stainless Steels" at **Cincinnati.**

The speaker described the three major classifications of stainless steel and showed where the precipitation hardening stainless steels fit into this classification. He outlined the various heat treatments used in hardening Armco 17-7 PH, PH 15-7 Mo, 17-4 PH and 17-10P. High-strength properties attained by these treatments were cited. An interesting series of electron micrographs at 24,000× magnification were presented. These showed differences in the final heat treated structure believed to be caused by a precipitation hardening phase or compound.

Following his discussion of the metallurgy of the precipitation hardening stainless steels, Mr. Marshall showed a series of slides published by the aircraft and missile industry covering future trends in airframe performance. Elevated temperature properties of the PH steels were given to show how these steels will meet requirements.

With this background, the speaker presented a series of slides showing numerous applications of 17-7 PH, PH 15-7 Mo, and 17-4 PH in the aircraft and missile fields. Prominent among these applications were: North American's B-70 Valkyrie strategic bomber that will require large quantities of PH 15-7 Mo, the BOMARC missile containing 17-7 PH fuel tanks and machined fittings, and Lockheed's F-104 and Convair's B-58 having many 17-7 PH brazed honeycomb panels and formed parts throughout their fuselage sections. Domestic applications of 17-4 PH were also shown, such as the control rods, trellis and drive mechanism in Duquesne Power and Light Co.'s atomic power plant at Shippinport, Pa. Mention was made of the prevalent use of 17-4 PH castings in the pressurized water system of the N.S. Savannah, the world's first nuclear-powered passenger-cargo vessel.—**Reported by George W. Rebeck for Cincinnati.**

Past President Is Guest Of West Central Florida

Speaker: C. H. Lorig
Battelle Memorial Institute

C. H. Lorig, past president A.S.M. and technical director, Battelle Memorial Institute, gave a talk on "Materials for the Space Age" at a meeting of the **West Central Florida.**

Dr. Lorig discussed present and future research trends and current developments in metallurgy. He pointed out that the designers of the space era require new materials and further improvement of the existing ones to provide the high strength and corrosion resistance at the temperature extremes encountered by all industries in improving products.

Dr. Lorig was accompanied to the West Central Florida Chapter by Ted DuMond, field secretary A.S.M., who spoke about ways to expand and promote the local Chapter, the Bill Eisenman Memorial, Metals Engineering Institute, and Chapter responsibilities.—**Reported by W. C. Lohe for West Central Florida.**

Outlines Pressure Vessel Problems

Shown Chatting With New York Chapter Officers During a Meeting Which Was Held Recently Is Carl H. Samans, Standard Oil Co. (Ind.), and National Trustee A.S.M., Who Spoke on "Some Problems of Steel Pressure Vessels". From left are: Angelo Alessandria, secretary; Dr. Samans; Leslie Seigle, chairman; and Ludwig Anselmini, vice-chairman of the chapter

Speaker: Carl H. Samans

Standard Oil Co. (Ind.)

At a recent meeting of the **New York Chapter,** Carl H. Samans, associate director of engineering research for Standard Oil Co. (Ind.), and national trustee A.S.M., spoke on some "Problems With Steel Pressure Vessels".

Confining his attention to four types of steel—carbon steel, molybdenum and chromium-molybdenum low- and intermediate-alloy steels, and the ferritic and austenitic stainless steels —Dr. Samans started by defining the presently accepted stress-temperature limits. Up to a temperature of 1000° F., carbon steel is the cheapest but has the lowest allowable stresses. Low-alloy steels of 1¼% Cr-½% Mo and 2¼% Cr-1% Mo appear to be about equal and excel the other low and intermediate-alloy steels in high-temperature strength.

In considering the need for post-welding heat treatment of these low-alloy steels, Dr. Samans pointed out that any composition having more than 1¼% Cr does not have adequate weld metal ductility and always has to be heat treated.

Steels containing less than 0.7% Cr are not stable in the pearlitic form, tending to revert to iron and graphite, but no serious failures have occurred for this reason.

On the point of stress rupture, he mentioned the frequent case of local overheating. Usually, for tubes operated at high pressures, for example, the failure takes the form of splitting or tearing, splitting if there has been no corrosion or erosion to reduce the tube section, tearing where the section has thinned fairly uniformly over a sizable area. When these steels are tested beyond the normal operating range, ordinary carbon steel shows better stress rupture life than 1¼% Cr-½% Mo-¾% Si (above 1500° F. at 2500 psi.).

Tracing the metallurgical aspects of failure of a reactor vessel, Dr. Samans found that a carbon-½% Mo steel 2½ in. thick became brittle enough so that the entire vessel was shattered by cracks caused by an internal explosion before the first pieces began to travel from their original location in the vessel. He estimated that the cracks may have developed at rates of 5000 to 6000 ft. per sec.

Another common and serious situation covered was hydrogen attack. This starts at temperatures higher than 400° F., when monatomic hydrogen is formed. A small, mobile atom or ion, monatomic hydrogen easily migrates into the steel of the containment vessel. Reactions there with carbon, carbides or oxides form methane or water vapor. Being much larger than hydrogen atoms, these molecules are trapped in voids and build up high pressures within the steel. Whereas the pressure reached by hydrogen within the metal cannot exceed the partial pressure of the gas outside the metal, there is no such limit on the pressures reached by these new compounds. Temperature versus allowable partial pressure of hydrogen data (the Nelson curves) was reviewed.

Another metallurgical problem arising from the chemical environment was that of sulphidization. Prevalent in the 650 to 750° F. range where 0.2 to 0.9% sulphur is present, this form of attack corrodes the steel at high rates, particularly if H_2 or H_2S is present. New studies of the subject throw the classical protective role of chromium in such cases into doubt.

In reviewing the behavior of stainless steels, Dr. Samans noted that even Type-410 can become brittle in the 750 to 1000° F. range, if the carbon content is high. This is a serious problem with any stainless steel containing more than 14% chromium. One treatment to remove this embrittlement is heating to 1200° F. and rapid cooling, but it will return later if held in the 750 to 1000° F. range.

Another interesting solution proposed to overcome sensitization of austenitic stainless steels is to keep any stainless equipment to be operated at temperatures over 800° F. in continuous operation for 18 months or two years after initial startup. However, as Dr. Samans pointed out, this procedure, which would allow chromium to diffuse back into regions of the alloy depleted by the precipitated Cr_4C, is of theoretical interest only. Process adjustment or the need to inspect equipment will almost always bring about a shutdown within the first several weeks. Normal practice, at the time of this shutdown, is to purge the equipment with steam—both to rid it of the processed material and to fill the system with an inert material. Unfortunately, the condensate formed when sulphides are present is not at all inert and can lead to intense intergranular attack because of the Cr_4C formed along grain boundaries and the consequent chromium depletion of these regions.

Three remedies for situations of this kind are:

1. Reducing carbon content to 0.03% or less.
2. Stabilizing the contained carbon with columbium or titanium.
3. Heat treating (1600° F. for 4 hr.) to stabilize the carbon by forming large well-dispersed carbides.

Dr. Samans recommended the third as being the most reliable.

Dr. Samans concluded with a discussion of sigma phase formation and the concurrent formation of carbides, both tending to embrittle the alloy.—**Reported by Bruce Fader for New York Chapter.**

Akron Holds Panel Meeting

A general panel discussion, moderated by James F. Snider, Goodyear Aircraft Corp., was presented by the **Akron Chapter** at a recent meeting. Panel members included Edward G. Patrini of McNeil Machine & Engineering, who spoke on "Welding", John A. Wyman, Permold Co., who covered "Casings", Arthur E. Marble, H. & M. Metal Processing Co., who discussed "Heat Treating", and Stephen H. Finley, Babcock & Wilcox Co., whose subject was "Hot and Cold Forming".

Some of the questions submitted to the panel were: What effect does copper content have on forging? Will vacuum melting increase hot workability? What depth of hardness can be expected from flame hardening ductile iron? Are there any toolsteels which cannot be atomic welded?—**Reported by C. F. Moewe for Akron Chapter.**

Corrosion Is Wichita Topic

R. A. Balbierz, Supervisor of Protective Finishes Group, Engineering Process Unit, Boeing Airplane Co., Spoke on "Chemical and Metallurgical Aspects of Corrosion" at a Meeting in Wichita. He is shown, at right, with A. L. Paxhia, chairman of the Chapter

Speaker: R. A. Balbierz

Boeing Airplane Co.

"Chemical and Metallurgical Aspects of Corrosion" were presented at a meeting in **Wichita** by R. A. Balbierz, Boeing Airplane Co.

Knowledge of the fundamentals of corrosion and corrosion protective systems is an important consideration in all fields of design engineering. Pure metals and metal alloys, when exposed to natural environments, always react chemically to revert to their basic state as found in nature. Thus, iron or steel exposed to moisture revert to iron oxide while gold and silver remain unaffected by such exposure. The need to design corrosion control into all products for durability and reliability should thus be obvious.

Corrosion is normally an oxidizing process which takes place on a metal surface exposed to a solution of ions (electrolyte). The electrical potential generated by the metal in contact with an electrolyte is indicative of the rate at which corrosion proceeds. The higher the potential the faster will be the corrosion rate unless an excess of oxygen is present, in which case passivity may occur and both the potential and corrosion rate will decrease accordingly. Certain metals, such as aluminum and stainless steel, can be passivated so as to provide effective corrosion resistance properties under normal use conditions. As one becomes familiar with the basic mechanisms of corrosion it becomes apparent that the role of oxygen is multifold and somewhat complex.

Although the chemical reactions of corrosion are usually similar and straightforward, the causes and effects of such corrosion may be highly complex. In order to identify specific types of corrosion, descriptive definitions such as galvanic corrosion, pitting corrosion, crevice corrosion, stress corrosion, fretting corrosion and intergranular corrosion have been originated to assist in further study of their causes, effects and subsequent preventive measures. Such studies fall under the overlapping scope of both chemistry and metallurgy.

Visible evidence of corrosion may be studied primarily by the chemist, who after determining the cause may require metallurgical assistance to determine the effects of such corrosion on the physical properties of a part so that a decision may be reached on the necessary preventive measures. Certain forms of corrosion, such as stress corrosion and intergranular corrosion, may require metallurgical study of the internal grain structure before positive identification of the type of corrosion can be established. Once identification of form is established, causes and effects again become an overlapping chemical and metallurgical problem for resolution of preventive measures.

To the young man desiring to specialize in the field of corrosion technology, the speaker highly recommended a dual educational background. A fundamental knowledge of chemistry and electrochemistry coupled with basic metallurgy should provide him with optimum "tools of the trade" to cope with the magnitude and complexity of this field of specialized engineering. — **Reported by Dale E. Zabel for Wichita.**

Talks in Utah on Nickel

Albert G. Zima, Right, West Coast Supervisor, International Nickel Co., Inc., Expresses Appreciation to J. M. Carrera, Utah Chairman, for Beehive Memento Presented to Him When He Presented a Talk on "Nickel, a Versatile Metal", at a Recent Meeting

Speaker: Albert G. Zima

International Nickel Co.

"Nickel—a Versatile Metal" was the subject of a talk given by A. G. Zima, supervisor, West Coast Field Section, International Nickel Co., at a meeting of the **Utah Chapter.**

Mr. Zima reviewed the history of nickel from the early history of man and discussed the occurrence of nickel in meteorites. He also gave a brief resume of the discovery and separation of nickel from various ores.

Mr. Zima outlined the use of nickel alloys during World War I in armaments, and explained the need for the development of peacetime uses for nickel in the period following the war. The development of nickel alloys and their relationship to industry constitutes one of the most interesting phases of the use of this material. The versatile part nickel has played in these developments was outlined.

The use of nickel in steel, including stainless steels, constitutes its greatest use at the present time. Nickel steels lower the critical temperature range of steel, retard the rate of reaction through the transformation range and increases the strength of steel without depreciating ductility.

Nonferrous nickel alloys constitute the second largest use of nickel. They are highly useful and resistant to corrosion. He also mentioned the use of metallic nickel in the chemical, electroplating and electronic fields. He then discussed the use of nickel in cast iron in various industrial applications. Nickel used in cast iron improves machineability, improves wear resistance, increases strength and toughness and improves corrosion resistance.

In summary, Mr. Zima pointed to some of the dual roles which nickel plays, including its use in high and low-expansion alloys, alloys for use in high and low-temperature applications and use in magnetic and nonmagnetic alloys.—**Reported by D. G. Wilson for Utah Chapter.**

A.S.M. is the largest publisher of books for the metals industry in the world.

Orville Cullen, Surface Combustion Corp., Presented a Talk Before the Pittsburgh Chapter on "Preparation of Controlled Atmospheres and Their Effects During Heat Treat Processing". Shown are, from left: Gilbert Soler, chairman; Mr. Cullen; and C. Sawyer, member of program committee

Controlled Atmospheres Reviewed at Pittsburgh

Speaker: Orville Cullen

Surface Combustion Corp.

Orville Cullen, manager, Research and Development Dept., Surface Combustion Corp., spoke at a meeting of the **Pittsburgh Chapter** on "Preparation of Controlled Atmospheres and Their Effects During Heat Treat Processing".

Mr. Cullen limited his talk to prepared or manufactured atmospheres. A brief history of controlled atmospheres was given by Mr. Cullen in which he stated that direct combustion, free from uncombined oxygen to minimize scaling, was probably the first step in the use of prepared atmospheres. A brief outline of the various generated gases, namely, RX, DX (lean and rich), NX, HNX and HX, was given and discussed. They are generated from gas and air or air-steam mixtures. Carbon monoxide, hydrogen, water vapor and CO_2 are the active constituents through which atmosphere control is maintained.

A schematic diagram chart was used to demonstrate the methods for preparing the several different types of atmosphere which can be produced from natural gas or from the various liquefied petroleum gases. The chart clearly demonstrated the various steps involved in producing the several controlled atmospheres by exothermic or endothermic means. The reasons for catalytic activity, chemical reactions and mechanical absorption were described to indicate the involved procedures needed for producing many of these gaseous atmospheres. Additional charts described the analyses of the atmospheres and their comparative costs.

A discussion of particular interest was of the equilibrium gas reactions $CO\text{-}CO_2$ and $H_2\text{-}H_2O$ as they refer to carbon control. Carbon is controlled in carburizing by CO_2 or H_2O (dew point) determinations when using a normal controlled gas with an approximate composition of 20% CO, 40% H_2, 40% nitrogen. The CO_2 and H_2O by volume may then be plotted against the carbon in steel for any given temperature. The relationship of the percent carbon to the dew point for any given temperature is also plotted. An outline of a typical carburizing cycle was given as a plot of temperature and dew point versus time and carburizing gas flow. These reactions and the equipment to automatically control them were discussed. The theoretical curves for carburizing, wherein the case depth in thousandths of an inch are plotted versus the time in hours at specific temperatures, were presented. The carburize and diffuse cycle was also discussed as it is used to equalize surface carbon. Carbonitriding, carbon restoration and homogeneous carburizing of sheet metal products were also covered.—**Reported by A. E. LaMarche for Pittsburgh.**

Cites Developments in Powder Metals

Carl G. Johnson, Vice-President in Charge of Research and Development, Presmet Corp., Who Presented a Talk on "Development in Powder Metallurgy" at a Meeting in Rochester, Is Shown, Center, With Two Chapter Men

Speaker: Carl G. Johnson

Presmet Corp.

Carl Johnson, vice-president in charge of research and development, Presmet Corp., presented a talk on "Development in Powder Metallurgy" at a meeting of **Rochester Chapter.**

Mr. Johnson opened his lecture with an interesting description of the powder metallurgy processes employed by some African tribes in the manufacture of various implements and weapons over the past 6000 years. Parts are made in sponge and wrought iron and have surprisingly good mechanical properties.

Physical and mechanical properties of various sintered materials were discussed and Mr. Johnson went into methods of strengthening and the elimination of voids. At the present time 90 to 95% of theoretical density has been obtained without infiltration and it is the aim of research and development to obtain theoretical properties of wrought materials.

The talk was well illustrated with slides and a display of parts showing a variety of materials and applications.—**Reported by N. Iannone for Rochester Chapter.**

Speaks on Nuclear Systems At Saginaw

James R. Johnson, Left, Atomic Energy Coordinator, Minnesota Mining and Manufacturing Co., Who Spoke on "Nuclear Systems and Materials" at Saginaw Valley, Is Shown With Karl Schwartzwalder, Meeting Technical Chairman

Speaker: James R. Johnson
Minnesota Mining & Manufacturing Co.

Saginaw Valley Chapter honored past chairmen and enjoyed a talk on "Nuclear Systems and Materials" by James R. Johnson, Atomic Energy Coordinator, Minnesota Mining & Manufacturing Co., at a recent meeting.

The speaker outlined the development of the basic commodity, "energy", up through the ages, pointing out the depletion of our fossil sources and the great need to develop an efficient nuclear system to run our power plants, ships, trains and planes. The improvement of efficiency, as stated in the laws of thermodynamics, can be achieved by raising the operating temperature. If a working temperature of 1200° F. can be maintained, an atomic energy power plant will obtain an over-all efficiency of 35%. The cost per kilowatt hour could then approach that of steam systems. Of the several methods now available the gas cycle system for converting nuclear energy to a useable form seems the most practical at the higher temperatures and several such systems are under development. Therefore, a major search is on for materials to use in gas-cycle nuclear power systems which will withstand high temperatures and retain the necessary properties. Other material requirements peculiar to a nuclear system are:

1. The reactor core materials must not absorb neutrons.
2. They must be able to withstand radiation damage.
3. The fuel elements must retain the fission products at high temperatures.

The retention of the fission products has proved the most formidable.

Some two-thirds of the elements in the periodic table are unsuitable because of their undesirable nuclear properties. One of Minnesota Mining's approaches is to use graphite as a container or capsule material to hold the atomic fuel. Graphite possesses many desirable properties, namely: low thermal neutron absorption, high refractoriness, high thermal conductivity, good thermal and mechanical shock properties and good machineability. However, this material is porous with poor erosion resistance and also susceptible to oxidation at high temperatures. These deficiencies have been overcome by applying a 0.003-in. adherent coating of siliconized silicon carbide. Many engineering tests have been performed on the siliconized silicon carbide capsules and balls. Slides were shown listing results of impact, thermal shock, high-temperature resistance, immunity to acid attack, corrosion, permeability and the ability to retain the fission products. The results show considerable promise. The uniform silicon carbide overlay augments the properties of the graphite to make the composite capsule a suitable material to withstand the extreme conditions of an atomic reactor.

Other interesting products displayed by the speaker were several types of corrugated honeycomb sections suitable for heat exchangers made from ceramics. The materials used in this sintered product can range from the high-melting point zirconia to the lowest melting point ceramics, the novel feature of this product being the curves and short radii incorporated in the design, demonstrating that fired ceramic materials can be made in shapes formerly limited to the ductile metals.—**Reported by H. D. Boggs for Saginaw Valley.**

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the Transactions of the Society and possible presentation before the next national meeting of the Society, in Philadelphia, Oct. 17 to 21, 1960.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 42nd National Metal Congress and Exposition.

Papers may be submitted any time up to Apr. 15, 1960, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made in May 1960. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention.

Reprinting of accepted papers is done quarterly; notification of their availability is published in *Metals Review*.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of T. C. DuMond, field secretary and program coordinator, American Society for Metals, Metals Park, Novelty, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

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(Continued on following page)

Tri-Chapter Meeting (Cincinnati-Columbus-Dayton)

In Cincinnati, Apr. 27-28, 1960

Materials—Key to Space Flight

Session 1—Space Flight, Its Unique Demands on Materials

Chairman: G. Marvin Ault, N.A.S.A.

Objectives and Timing of the National Space Programs, by E. M. Cortright, Chief, Advanced Technology Programs, N.A.S.A.

Materials Considerations in Launching Space Vehicles, by W. J. Harris, Executive Director, Materials Advisory Board, National Academy of Sciences.

The Space Environments, Its Demands on Materials, by John C. Simons, Director, Physics and Vacuum Technology Programs, National Research Corp.

Materials Considerations in Space Vehicle Atmospheric Re-Entry, by W. S. Pellini, Superintendent, Metallurgy Div., U. S. Naval Research Laboratory.

Session II—Materials for Space Vehicle Launching Systems

Chairman: Julius J. Harwood
Office of Naval Research

Materials for Liquid Propellant Rocket Motors, by L. L. Gilbert, Aerojet General Corp.

Materials for Solid Propellant Motor Cases, by W. Cohen, U. S. Navy, Bureau of Weapons

Materials for Hot Parts of Solid Propellant Rocket Motors, by E. L. Olcott, Head, Materials Group, Atlantic Research Corp.

Materials for Nuclear Reactors, by G. Deutsch, Refractory Metals Branch Chief, N.A.S.A.

Session III—Materials for Use in Outer Space

Chairman: L. R. McCreight, General Electric Co.
Missiles and Space Vehicle Dept.

Testing of Materials to Withstand the Space Environment, by M. A. Steinberg, Lockheed Missiles and Space Div.

Materials for Direct Energy Conversion in Space Vehicles, by Clarence Zener, Director, Research Laboratories, Westinghouse Electric Corp.

Nuclear Powered Turbomachinery for Space Vehicles, by M. A. Zipkin, Flight Propulsion Laboratory Dept., General Electric Co.

Materials for Ion and Plasma Jet Space Propulsion, (Speaker to be announced)

Session IV—Materials for Atmospheric Re-Entry—The Must to Return Man From Space

Chairman: I. Perlmutter, Materials Laboratory,
Wright Air Development Center, U.S.A.F.

Materials for the Project Mercury Capsule, by M. L. Ramey, McDonnell Aircraft Corp.

Materials in the X-15 Aircraft, by W. A. Reinsch, Supervisor, Metals Unit, Materials and Processes Engineering, North American Aviation

Materials for Lifting Re-Entry Vehicles, by W. H. Dukes, Manager, Dyna-Soar Structures Dept., Bell Aircraft Corp.

Ablation Materials for Re-Entry, by I. Gruntfest, Aerosciences Laboratory, General Electric Co., Missile and Space Vehicle Dept.

Speaks on Steel Castings

Walter H. Dunn (Left), Vice-President and General Manager, Pacific Alloy Engineering Corp., Who Spoke on the "Foundry's Answer to the Demand for Better Steel Castings" at a Meeting Held by North Texas Chapter, is Shown With John W. Mitchell, Technical Chairman. He gave a brief history of casting and brought out the importance of developments of the past ten years, citing many advantages of casting over other methods of manufacture for certain applications

Standing Committees (Continued)

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W. A. Pennington (Board Representative)		

Describes Evolution of Compact Cars

Pictured at a Meeting of New York Chapter During Which E. D. Marande, Ford Motor Co., Spoke on the "Compact Car" Are, From Left: Floyd A. Lewis, Technical Chairman; Frank LaQue, International Nickel Co., Inc.; Les Seigle, Chairman; Mr. Marande; and Ludwig Anselmini, Vice-Chairman

Speaker: E. D. Marande

Ford Motor Co.

Edward D. Marande, manager, scientific laboratory metallurgy department, Ford Motor Co., described the evolution of the new "Compact Cars" at a meeting of **New York Chapter.** His talk covered the innovations in the motor and body of the new Ford Falcon and the metallurgical work behind them.

As one example, Mr. Marande cited the 90 hp. engine used in the Falcon. Though made of cast iron, it weighs only 346 lb., 175 lb. lighter than a standard design. To accomplish this, Ford's technical staff evolved a design which makes the intake manifold integral with the cylinder head and the valve cover an integral part of the engine block.

Other innovations include the use of differentially galvanized steel for the unitized body frame. This process places a heavy deposition of galvanizing zinc on the more inaccessible parts while maintaining a lighter coverage over exposed parts to be welded or painted. Aluminum-coated steel has been used for valves and other parts.

Two of Ford's research projects came under discussion—rolled aluminum automobile radiators and superstrong steels.

Aluminum radiators have been built and tried in the Ford program. Two targets of the current work are better joining methods and reduction of bulk of the finished unit.

The superstrong steels now being made experimentally are accomplished by ausforming. This method makes use of extremely heavy mechanical working of the steel in the 800 to 1050 F. temperature range, followed by a transformation to martensite and tempering.

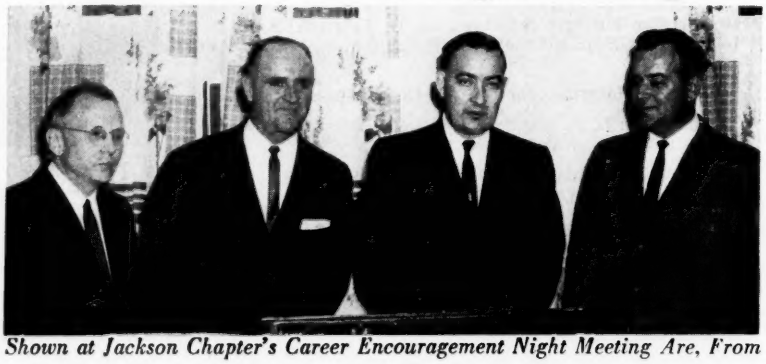
The resultant material has an exceptionally small grain size of the martensite. The yield and ultimate tensile of this steel can be well over 400,000 psi. with as much as 8% elongation. These properties are attributed to the extremely fine grain size. A typical alloy composition is 0.48% C (steel 48) and 0.63% C (steel 63), with 3% Cr, 1.5% Ni, 0.75% Mn, 0.5% Mo and 1.5% Si.—**Reported by Bruce Fader for New York Chapter.**

Tri-City Holds Panel-Type Meeting on Metal Machining

A panel discussion on the "Machining of Metals" was held by the **Tri-City Chapter.** The panel members were: A. E. Drake, John Deere Harvester Works; F. S. Burnside, Farmall Works, International Harvester Co.; F. H. Lockard, John Deere Waterloo Tractor Works; and F. J. Daasch, Rock Island Arsenal. E. M. McCullough served as moderator for the technical program.

The procedure of the panel was unique as there was no formal presentation by the members. The entire program consisted of answering questions from the floor on machining problems. There was considerable interest relative to the application of ceramic cutting tools. It was evident that considerable care must be used currently in the selection of work and the manner of setting up the operation. The need for continued effort towards a better understanding of the fundamentals of metal cutting was expressed. The value of data from plant experience as a starting point, particularly with a new set-up, was stressed.—**Reported by F. J. Daasch for Tri-City.**

At Jackson's Career Night Meeting



Shown at Jackson Chapter's Career Encouragement Night Meeting Are, From Left: Howard Womochel, Program Chairman; C. G. Stiles, Career Encouragement Chairman; D. D. McGrady, Associate Professor of Metallurgical Engineering, Michigan State University; and E. P. Eppler, U. S. Steel Corp.

At the **Jackson Chapter's** annual "Career Encouragement Night" meeting, Charles Stiles, chairman of the student affairs committee, invited 45 students and 12 instructors, representing all the area high schools, as Chapter guests. Since the Jackson Chapter was founded in 1956, it has been working with the high schools in the area in an effort to encourage more students to study metallurgical engineering in college.

E. P. Eppler, supervisor of service metallurgy, U. S. Steel Corp., presented a film entitled "Steel—Man's Servant" which told the story of steel, from the mines to finished products.

Following the film, Mr. Eppler conducted a question and answer period with the students, who actively participated.

The second half of the program was devoted to the educational requirements of metallurgy. Carl Landenberg, technical chairman, introduced D. D. McGrady, assistant professor of metallurgical engineering, Michigan State University, who gave a brief history of metallurgy and discussed with the students how best to prepare in high school for a metallurgical career. In addition, he described the many opportunities in the field due to the demand for metallurgists in the rapidly expanding metals industry.—**Reported by D. R. Varblow for Jackson.**

Gives Picture of Life of Metallurgist in Japan

Speaker: W. H. Rice
Electric Steel Foundry

W. H. Rice, metallurgical consultant for Electric Steel Foundry, spoke at **Puget Sound Chapter** on "Observation of a Metallurgist in Japan". Dr. Rice recently returned from Japan where he acted as metallurgical consultant to Mitsubishi Yuka, the petrochemical division of that nation's largest industrial complex.

Dr. Rice obviously thoroughly enjoyed his opportunity to live and work with the Japanese people, to see a country of great natural beauty and to observe a society so different and yet so like our own. Otami, site of the new Mitsubishi plant, is a city which does not cater to western tastes, so Dr. Rice lived in a manner identical to that of his Japanese associates. This, and the fact that his work kept him there for a number of months, gave him an opportunity to more fully understand the motivations of the Japanese businessman and engineer than any casual visitor.

Among the many points of interest covered in the talk was the young Japanese graduate and his future prospects. This young man would accept a position and then very likely remain with that company throughout his entire professional life. For a technical man competition is keen, remuneration is below American standards, and retirement is compulsory at age 55. He receives one lump sum commensurate with his position on his retirement. This, and his savings, must be made to last, because there is no pension plan.

Dr. Rice was impressed with the capability of the engineers with whom he worked and found them to be extremely practical, conscientious and friendly. He also found that the Japanese had the same aversion to illiteracy as Americans and that our educational systems are comparable.

Dr. Rice discussed many sociological aspects and summarized his talk by stating that, while the Japanese possess a totally different outlook, he found much in them to be admired and even emulated.—**Reported by Clement Walker for Puget Sound.**

W. H. Eisenman Memorial To Set Up Rare Book Library

Memorial contributions received by the American Society for Metals following the death of William H. Eisenman in May, 1958, will be used to create a collection of rare and important books on metallurgy, honoring the man who for 40 years served as the Society's national secretary, and who was also a founder member of the Society.

A committee, headed by Cyril S. Smith, professor at the Institute for the Study of Metals, University of Chicago, will administer the memorial fund and any future contributions, and direct the purchase of the books which will comprise the "William H. Eisenman Collection". The books will be placed in the Society's library, Metals Park, Novelty, Ohio.

Serving with Dr. Smith on the Committee by invitation of Walter Crafts, Society president and associate director-technology, Union Carbide Metals Co., are J. H. Brennan, Union Carbide Metals Co., Marjorie R. Hyslop, managing editor, and E. E. Thum, editor-in-chief, *Metal Progress.*

"We hope the Eisenman Collection will become a notable one to which scholars and historians from around the world will turn. Every effort to find and preserve old books on the science of metalworking will be made by the Society and its committee", said A. R. Putnam, managing director A.S.M.

While the William H. Eisenman Collection is just being assembled, its earliest volume is Schreittmann's "Probierbuchlein", a book on testing printed in 1578.

Reviews Materials Behavior at Texas

"Materials—Their Behavior and Properties" Were Discussed at a Meeting Held by Texas Chapter by Robert H. Pry, Ceramic Studies Section, General Electric Co. Shown are, from left: William H. Greer, vice-chairman; William D. Gilder, chairman; Dr. Pry; and L. J. Vieau, secretary-treasurer

Speaker: Robert H. Pry
General Electric Co.

A talk on "Materials—Their Behavior and Properties" was presented before members of the **Texas Chapter** by Robert H. Pry, Ceramic Studies Section, Metallurgy and Ceramics Research Dept., General Electric Co.

The theme of Dr. Pry's talk was that "basic research today will tell us what materials we will have tomorrow". This theme was developed by a review of the technical literature for the past 40 years. It was pointed out that historically it takes about ten years from the research stage of some material until it finds its application in industry.

A break-down of the origin of technical papers on materials showed an increase from industry and universities during the past 40 years. Papers coming from government sources remained about the same. A further breakdown of these papers, however, revealed that the government was paying a large part of the bill for the research.

It was stated that, although money is important and necessary for the advancement of scientific research, it by itself is not enough. The advancement of Russia, for example, was not considered to be due to more money or better scientific minds, but to their reduction of the time from the research stage of a material to its application. Our ten-year lag in this area was stressed several times and it was emphasized that this time must be shortened if we are to advance at a faster pace.

As examples of current research in metals, Dr. Pry showed two films. In the first, he mentioned that the accidentally discovered tin whiskers by Bell Telephone scientists led to the discovery that other metals could form in the same manner. These whiskers are the most perfect form in which these metals have ever existed. Since there are no imperfections the strength approaches the theoretical strength of that element, which in some cases may be 1000 times greater than found in the commercially produced metal.

In another film "The Movement of Dislocations in Aluminum Foil", actual movement of dislocations were seen for the first time in an electron microscope. A sheet of aluminum foil was heated at a point by an electron beam, and the resultant thermal stresses caused dislocations to move from subgrain boundaries to grain boundaries at a speed approaching 1/10 the speed of sound.—**Reported by W. T. Unfried for Texas Chapter.**

Aborn at Detroit

R. H. Aborn (Right), U. S. Steel Laboratory for Fundamental Research, Who Presented a Talk on "Toughness Without Tempering" at a Meeting Held by Detroit Chapter, Is Shown With N. Lazar, Wayne State University, Who Was Technical Chairman of the Meeting

Speaker: R. H. Aborn

U. S. Steel Corp.

R. H. Aborn, director, U. S. Steel Laboratory for Fundamental Research, and past national treasurer A.S.M., spoke on "Toughness Without Tempering" at a meeting held by **Detroit Chapter.**

Dr. Aborn contrasted the brittleness of quench-hardened high-carbon steels with the toughness of similarly treated low-carbon steels. It was shown that this outstanding improvement is associated with high-temperature formation of martensite and its subsequent tempering which occurs during quenching of low-carbon steels. The unique properties of these low-carbon martensites were discussed in relation to their structure.

A high-speed movie film was shown of the progress of cold work and associated transformation within a large grain of Type 301 stainless steel which was stretched 7% in 1 sec. and was taken at a maximum speed of 3000 fps.

The coffee speaker, R. C. Gerhan, spoke on "The Case of the Vanishing Dollar". Mr. Gerhan, a Republic Steel Corp. metallurgist by day, and economic sleuth by night, gave a very vivid portrayal of how inflation robs us all. **—Reported by T. C. King for Detroit.**

National President Walter Crafts presented his talk "Facing the Productivity Challenge: Men and Metals of the Next Decade" at a meeting held by the Purdue Chapter. He was accompanied to the meeting by T. C. DuMond, field secretary A.S.M.

For an account of Mr. Craft's talk, see item above.

Receives Eisenman Medal

National President Walter Crafts (Right), Associate Director, Union Carbide Metals Co., Is Shown Receiving the William H. Eisenman Medal Which Is Awarded by the Philadelphia Chapter Every Year From Chairman Fred Cooper During a Recent Meeting

Speaker: Walter Crafts

Union Carbide Metals Co.

Walter Crafts, associate director, Union Carbide Metals Co., and national president A.S.M., received the William H. Eisenman Medal, at a meeting of the **Philadelphia Chapter.** Mr. Crafts gave a talk on "Facing the Productivity Challenge—Men and Metals of the Next Decade".

Mr. Crafts told the large audience that the metlaworking industry benefited from more than half of over 11 billion dollars spent annually in the United States on research and development as compared to less than 5 billion dollars annually on new plant investment. He then illustrated some important developments that should result in accelerated capital investment in the metalworking industry.

One was the development of unusually high strength by the Ford Motor Co. through rolling steel in the austenitic condition at 1000° F. to achieve tensile strength of over 400,000 psi., with occasionally much higher results that may ultimately produce a significantly higher strength-weight ratio. Another approach toward the million pounds per square inch goal is in ultrafine powder compacts in which the grain size is so fine as to make dislocation movement difficult.

Reactive and refractory metal production such as zirconium, vanadium, columbium and tungsten requires new plants that must be based on anticipation of needs and flexibility in processes. Their use in nuclear energy and in space vehicles appears to require accelerated development and volume production before their ultimate utility can be visualized.

Rapid development of processing methods for conventional as well as newer metals, and composites of metal with ceramics and refractories, are resulting in new designs and new techniques. Forming processes, such as extrusion and explosive forming, are finding new uses, joining processes are much more versatile and controllable, machining of many types is becoming more automatic. Operations research for engineering processes is being more widely adopted to increase productivity and can be expected to contribute largely to future growth.—**Reported by N. J. Petrella for Philadelphia.**

Titanium Progress Outlined At Meeting in Syracuse

Speaker: W. W. Minkler

Titanium Metals Corp. of America

Ward W. Minkler, manager, technical service and sales development, Titanium Metals Corp. of America, spoke on "The First Decade of Titanium" at a recent meeting of the **Syracuse Chapter.**

He discussed the physical properties and metallurgy of titanium, stating that its attractiveness lies in its density, strength to 1000° F., abundance of ore and corrosion resistance. Titanium is used in jet engines because of its resistance to stress corrosion and its fatigue strength.

A part of the talk was devoted to the structural application of titanium and its extensive use in airframes. Use in missiles, because of its ability to avoid embrittlement at low temperatures, was also discussed. The excellent corrosion resistance of this material was brought out and slides showing this and various other applications were presented. — **Reported by G. Trojanowski for Syracuse Chapter.**

Talks on Embrittlement

George A. Ratz (Center), Research Metallurgist, Duquesne Works, U. S. Steel Corp., Who Spoke on "Embrittlement of Steels" at a Meeting in New Haven, Is Shown With Fred Storm (Left), Technical Chairman; and J. Halloran, Vice-Chairman of the Chapter

Reviews High-Strength Steels

John C. Hamaker (Left), Director of Research, Vanadium Alloys Steel Co., Who Spoke on "High-Strength Steels for Aircraft and Elevated Temperature Applications" at a Meeting Held in Cincinnati, Is Shown With Al Pfetzing, Chairman. (Reported by G. W. Rebeck)

Presents Talk on High-Strength Steel at Texas

Speaker: William C. Schulte

Propeller Div., Curtiss-Wright Corp.

A talk entitled "Fatigue Studies of High-Strength Steels" was presented at a meeting of the **Texas Chapter** by William C. Schulte, chief metallurgist, Propeller Div., Curtiss-Wright Corp.

Mr. Schulte stated that his company has been conducting an Air Force research development program for several years, part of which involved a study of the fatigue properties of aircraft quality 4340 alloy steel. He reviewed a few known instances of fatigue failures in well-known aircraft such as the Convair B-36, the Boeing B-47 and a late-model fighter-type aircraft. He indicated that the aircraft and missile designers are expecting greater performance of high-strength materials with minimum weight. The designers also wish to use these materials at maximum efficiency and capacity.

The speaker suggested that designers need to give due consideration to such points as material form, methods of heat treatment, machining and fabrication methods, inspection and quality control procedures, environment and service and overhaul methods. All of these factors form a chain, of which any one can be the "weak link".

With the aid of slides, Mr. Schulte defined and explained various probability S-N curves derived from tests involving over 3000 specimens from a single heat of aircraft quality SAE 4340 steel heat treated to 140,000, 190,000, 230,000 and 260,000 psi. ultimate tensile strength. Testing of various other high alloy steels was included in his discussion, one of which was 52100 bearing steel.

The speaker concluded by stating that cleanliness (minimum number and size of inclusions) of high-strength materials is a necessity for maximum performance, fatigue life can be improved by nitriding and/or shot peening, and materials capable of being tempered at high tempering temperatures give better fatigue life and strength.—**Reported by Fred N. Lamoureux for Texas.**

Covers Aluminum Refining And Alloying at Baltimore

Speaker: C. W. McCauley

Revere Copper and Brass, Inc.

"Aluminum Refining and Alloying" was the subject of a talk given by C. W. McCauley, metallurgical manager, Revere Copper and Brass, at a meeting of the **Baltimore Chapter.** Mr. McCauley's talk, accompanied by suitable slides, described in detail the various steps involved in transforming bauxite ore into conventional aluminum alloys. As a representative of Revere Copper and Brass, and a joint owner with Olin Mathieson in the Ormet Corp., Mr. McCauley was able to present a completely up-to-date picture of the aluminum industry.

The process begins when the bauxite ore from South America is unloaded at Ormet's alumina refinery at Burnside, La. This $55-million facility, located 30 miles south of Baton Rouge on the Mississippi River, is the world's most modern alumina refinery, having a capacity of 345,000 tons of alumina per year. Here the bauxite ore is changed by chemical means into alumina powder, two tons of bauxite ore yielding one ton of alumina powder.

The next step is to ship the alumina powder up the Mississippi and Ohio Rivers to Ormet's $110-million aluminum reduction plant at Hannibal, Ohio. This plant has an annual capacity of 180,000 tons of primary aluminum. Here the alumina powder is electrolytically reduced to primary aluminum, alloyed in some instances, and then cast into ingots, billets or slabs. From this point it is shipped to Revere Copper and Brass or to Olin Mathieson for fabrication into finished forms. Ormet Corp. sells no aluminum on the open market. Ormet's joint owners, Revere Copper and Brass, Inc., and Olin Mathieson Chemical Corp., receive the entire production.—**Reported by John H. Fuchsluger for Baltimore.**

Describes Residual Stresses At Meeting Held in Syracuse

Speaker: H. Neifert

Timken Roller Bearing Co.

H. Neifert, chief engineer of the physical laboratories, Timken Roller Bearing Co., spoke at a meeting of the **Syracuse Chapter** on "Residual Stresses and Fatigue Resistance of Large Structural Parts".

Residual stresses are defined as those that exist in parts after all machining and processing have been completed and can be either tension or compression. Residual stresses have rarely been isolated and usually are accompanied by some physical or phase change. In machined parts they appear as distortion in machining or can lead to premature failures.

Residual stresses may be produced by mechanical means, thermal gradients or chemical methods and can be of two kinds—macro or micro. Normally the macro stresses are measured.

Mr. Neifert discussed methods of improving the endurance limit by quenching from the tempering temperature, rolling and shot peening. Slides were shown throughout the talk to clarify specific points.—**Reported by G. Trojanowksi for Syracuse Chapter.**

Southwestern Metal Congress and Exposition, Dallas, May 9-13, 1960

A regional event of national significance to members of the American Society for Metals, the 2nd Southwestern Metal Congress and Exposition, will be held in Dallas, Tex., May 9-13.

This important metalworking event is built specifically around the needs and problems of metals men in a 600-mile radius of Dallas, and is geared to the exchange of down-to-earth ideas and information for immediate application in this rapidly expanding industrial region.

Metal Exposition

Over 120 metalworking firms throughout the nation already have arranged to be represented in the Southwestern Metal Exposition. They will be displaying everything from raw materials to the advanced products manufactured from these materials. New processes and applications will be demonstrated.

Allan Ray Putnam, managing director of the Society, emphasizes the unique educational benefits to be gained by visitors to the Congress in face-to-face communication with metals men able to answer specific technical questions.

Information on Southwestern Metal Show display areas can be obtained from Chester L. Wells, A.S.M. exposition manager, at Metals Park. He is being assisted in the Dallas-Fort Worth area by Robert K. Sorensen, sales engineer, Haynes Stellite Co., Houston, who is serving as exposition chairman on the North Texas Chapter committee, and by Fred McKimball, president, Southwestern Gage Company, Dallas.

Rodney W. Cramer, A.S.M. communications department representative, is in the area during February to contact potential exhibitors and to counsel with them on their exhibit space requirements.

Headquarters

The Exposition will be presented at the Texas State Fairgrounds, within easy distance of the Metal Congress, headquartered at the luxurious new Sheraton-Dallas hotel.

Members of a number of other technical and industrial societies are receiving invitations to the event, entitling them to enter the Metal Show as often as they desire during its five-day tenure.

Visitors to the Exposition are urged to allow two or more days for touring the exhibits. Scope of the display is such that its technical content is far too complex for complete coverage in a single visit.

A comprehensive series of technical sessions, presented in eight major sessions, will give the 2nd Southwestern Metal Congress immediate and lasting impact in the Southwest and in metalworking centers around the world.

There will be something of concrete importance for every technical man attending the sessions. Ideas and information will be exchanged on aircraft, rockets, space vehicles, chemicals, instruments, electronics, petroleum and other industries of increasing importance to metals men.

As one of its educational services to the metal industry, the American Society for Metals charges no admission to the Metal Congress.

Technical Program

T. C. DuMond, ASM Congress coordinator, says the Congress will offer a technical program without parallel in the Southwest. He is being assisted locally by W. H. Sparrow, Jr., supervisor, structures materials, Chance Vought Aircraft, Inc., Dallas technical chairman

DuMond and Sparrow announced the following tentative breakdown of the eight major sessions:

1. Steels for High Load Apcations: Hardenable Stainless Steels, H-11 Toolsteels,. Bearing Steels, Rock-Bit Steels.
2. Space Environment—Its Effect on Materials: Conductivity—Thermal and Electrical: Emissivity, Expansion—Thermal, Specific Heat, Effects of Vacuum, Effects of Radiation.
3. New Frontiers in Welding and Brazing: Ultrasonic Welding, Electron Beam Welding, CO_2 Welding, Tooling and Methods for Honeycomb Brazing.
4. Composite Materials for High-Temperature Applications: Metallic Alloys, Ceramics, Graphites.
5. New Metal Forming Techniques: Explosive Forming, Flow Turning, Hot Fluid Forming.
6. Heat Treatment of Problem Materials: Atmospheres, Salt Bath Operation, Surface Treatments —Carburizing, Nitriding.
7. Failure Analysis: Fatigue, Fractures Examination, Aircraft Crash Analysis, Die and Tool Failures.
8. Testing at High Temperature: Heat Sources, Temperature Measurement, Stress and Strain Measurement.

Stephen Maszy, Left, Chairman of the North Texas Chapter, and Delbert Dallefeld, Center, Chapter Secretary, Discuss Appointments for the Second Southwestern Metal Congress With Walter Crafts, National President A.S.M. Technical programs of the Congress will be held May 9-13 at the Sheraton-Dallas Hotel, with the North Texas Chapter as host. Mr. Maszy is with Perzy Heat Treat, Inc., Mr. Dallefeld is with Form Forge, Inc.

Gives Fine-Particle Magnet Properties

Fred E. Luborsky (Left), General Electric Co., Research Laboratory, Who Spoke on "Properties of Fine-Particle Magnets" at a Meeting of Eastern New York Chapter, Is Shown Demonstrating an Example to Two Members

Speaker: Fred E. Luborsky
General Electric Co.

F. E. Luborsky of the General Electric Co.'s Research Laboratory spoke before the **Eastern New York Chapter** on "The Properties of Fine-Particle Magnets."

The magnetic properties of materials are normally considered to be independent of specimen size. This is a reasonable assumption for bulk materials, whose permeability and coercive force depend upon the ease with which magnetic domain boundaries move through the material in response to applied fields. Below some critical diameter, however, particles become too fine to contain domain boundaries. These single-domain particles exhibit strikingly different magnetic properties associated with domain structures and magnetization processes unique to fine particles. For example, the coercive force of iron particles 150-angstrom unit in diameter, is more than 10,000 times that of bulk iron.

The talk reviewed the fundamentals of magnetism and presented the modern concepts of domain theory as it pertains to high coercive force materials. The permanent magnet properties of fine particles were compared to the properties predicted from theoretical considerations. A physical picture of magnet structures and the basic factors which determine their behavior were discussed.

The process for producing elongated single domain (ESD) fine particle magnets was described. The 150 Å ESD iron or iron-cobalt alloy particles are prepared by controlled electrodeposition into mercury, followed by thermal growth and treatment with a third metal to attain optimum particle shape and magnetic properties. The particles are then aligned by a magnetic field, compacted under pressure, freed of mercury by vacuum distillation and embedded in a suitable matrix. This is ground to a coarse powder and fed into automatic presses for realigning and compacting to the final magnet shape. The parameters controlling the significant steps of the process were discussed, and the advantages of magnets with artificial microstructures synthesized by this approach pointed out. The present process described produces commercial ESD iron and iron-cobalt magnets with energy products of 2.2 and 3.5 million gauss-oersteds, and laboratory ESD iron and iron-cobalt magnets of 4.2 and 5.0 million gauss-oersteds. Future developments in magnet quality were also discussed.—**Reported by George A. Young for Eastern New York Chapter.**

Fundamentals of Explosive Forming Given at Ontario

Speaker: R. S. Davis
Arthur D. Little, Inc.

R. S. Davis, Advanced Research Div., Arthur D. Little, Inc., lectured on "The Response of Metals to Explosive Loading" at a meeting of **Ontario Chapter.** While noting the importance of the subject with respect to the production of special shapes, he chose to discuss explosive loading as a tool for the basic study of the thermodynamic properties of metals at high pressures and for the elucidation of the fracture mechanism. He noted that in compressive shock waves in metals, pressures of up to 1,000,000 atmospheres are attained and these pressures may be accompanied by a 20% or greater decrease in volume.

Dr. Davis demonstrated how the reflection of the compressive shock wave from a free surface produced a return tensile pulse. Such a pulse produces a pure tensile (nonshear) fracture at a depth below the free surface corresponding to the maximum tensile stress attained. By the use of special techniques the intensity of the pulse and its profile can be determined, and values for the critical tensile fracture stress obtained. These are found to range from 260,000 psi. for aluminum to 620,00 psi. for nickel, and appear consistently to be about 12% of the theoretical cohesive strength. These values are quite independent of the alloy content of the basis metals. The consequences of the results with respect to springback and to the temperature dependence of notch brittleness were discussed.—**Reported by J. S. Kirkaldy for Ontario Chapter.**

Experts on Western Ontario Panel

A Stump the Experts Night Panel-Type Meeting Held by the Western Ontario Chapter Included the Following Members, From Left: W. H. Banyard, Liquid Carbonic Canadian Corp. Ltd.; Andrew Kabosi, Auto Specialties Manufacturing Co. (Canada) Ltd.; Vincent Decker, Budd Machine-Tool Co. Ltd.; and John B. Lundberg, Colonial Tool Co. Ltd.

Richmond Holds Student Activities Night

Shown Is Part of the Group of Science Teachers and Guidance Counselors Who Were Guests of the Richmond Chapter on Students Activities Night. Shown at the speakers' table, from left, are members of the panel, including: George Ossman, Jr., Hunter Window Corp., technical chairman of the meeting; A. R. Spreen, Southern Steel and Stove Co.; C. L. Brooks, Reynolds Metals Co.; K. W. Gay, Hill-Chase Co. of Virginia; and J. A. Burke, Jr., Experiment, Inc.

"Student Activities" was the subject of a recent meeting of the **Richmond Chapter.** Science teachers and guidance counselors of local high schools were invited to the meeting so that they could be acquainted with the metal industry in Richmond and have more information to pass along to their students, and to become acquainted with the men from whom they could obtain additional information.

The long-range planning behind this meeting was to develop a program that would interest more of the young people around Richmond in the field of metals. This program was aimed at the student who wants to specialize in his college curricula and also the student who will go straight to work after high school.

The actual program consisted of a panel of four speakers who outlined opportunities in the metals industry. Their talks were followed by a question and answer period. On the panel were C. L. Brooks, assistant director of metallurgical research, Reynolds Metals Co., J. A. Burke, executive vice-president, Experiment, Inc., A. R. Spreen, president, Southern Steel and Stove Co., and K. W. Gay, manager, Hill-Chase Steel Co. of Virginia. Technical chairman and moderator of the panel was George Ossman, Jr., manager, Hunter Window Corp.

Four different phases of metalworking were described. Mr. Brooks outlined types of work and job opportunities in research; Mr. Burke told how metals have helped push forward the frontiers of space and how design engineers are waiting for the materials to make possible even more startling accomplishments; Mr. Spreen described the continuing and urgent need for supervisory and technical men in the metal manufacturing and fabricating industries; and Mr. Gay outlined opportunities in metal sales and special requirements needed for success in selling.

Several members indicated their willingness to counsel students who show interest and aptitude for the metalworking field. Tentative arrangements were made for plant and laboratory tours for students and visits by members to school metal shops to discuss the additional uses and applications in the school curriculum of existing equipment.—**Reported by W. W. Berkey for Richmond.**

President Crafts at Buffalo

Shown at a Meeting of Buffalo Chapter During Which National President Walter Crafts Presented a Talk Are the Following Union Carbide Metals Co. Men, From Left: H. K. Intemann, President; Walter Crafts, Associate Director, Technology; Augustus B. Kinzel, Vice President, Research; and S. M. Norwood, the Vice-President and Assistant to the President

M. E. I. Swamped

The month of January was an unusually heavy one in the educational department of the American Society for Metals. In addition to the expected increase in individual student enrollments, the Metals Engineering Institute initiated in-plant study groups at Crucible Steel Co., Midland, Pa., Peninsular Steel Co., Detroit, Mich., M & C Nuclear, Inc., Attleboro, Mass., General Electric Co., Schenectady, N. Y., and Allegheny Ludlum Steel Corp., Leechburg, Pa.

In addition to these industrial groups, a number of A.S.M. chapters have also started M.E.I. courses, beginning in January, including the Fort Wayne, Rochester, Chicago-Western (two classes), Columbia Basin, Miami, Chicago (two classes), Manitoba and Oregon Chapters.

The following M.E.I. groups have just completed extension-class instruction: Haynes-Stellite Co., Kokomo, Ind., General Electric Co., Schenectady, N. Y., General Electric Co., Cincinnati, Ohio, General Electric Co., Erie, Pa., Utah Chapter (two classes), Los Angeles Chapter (four classes), Rochester Chapter and Columbus Chapter (four classes). Several others are nearing completion and plan to issue certificates of completion during March or April.

There are also indications that several more groups are planning to take the courses. Such heavy enrollments are keeping the headquarters staff extremely busy; however, they seem to have matters well in hand (see photo below.)

The services offered by the Metals Engineering Institute are continually being expanded with the introduction of new courses and many combined courses which offer a greater selection to individuals and groups with specific requirements.

Inquiries of all types are welcomed by M.E.I. The staff makes every effort to attend to the personal needs of group leaders and training directors to help outline how M.E.I. courses are best adapted to specific training needs.

For further information about these courses, write to: Metals Engineering Institute, American Society for Metals, Novelty, Ohio.

New Course Now Ready

The newest Metals Engineering Institute course, No. 8, entitled Machining of Metals, became available on Jan. 1. This comprehensive course was written by William Backer, formerly of the Cincinnati Milling Machine Co., and now with the Norton Co., Worcester, Mass.

Several other courses being developed and expected to be ready shortly include:

Course 12—Testing and Inspection of Metals

Course 14—Corrosion

Course 37—Welding Metallurgy

Course 41—Principles of Heat Treating

METALS ENGINEERING INSTITUTE **NEWS**

These Are "Firsts"

Jack L. Pinkston, plant superintendent at Southern Lead Co., Dallas, is the first student to graduate from Course 30, Primary and Secondary Recovery of Lead and Zinc. His over-all course average was an excellent 97. Jack is 36 years old, married, and has one child.

David C. Brown, welding engineer associated with Armour Research Foundation, Chicago, is the first student to graduate from Course 38, Oxy-Acetylene Welding. He also maintained an average 97 grade. Dave is a metallurgical engineer from Colorado School of Mines and the University of Kentucky. He is 28, married and has two children.

Walter A. Raymond, technical director of Landers Mora Cia, Medellin, Colombia, South America, is the first student to graduate from Course 3, Iron Blast Furnace Operations. His average grade was 92. Mr. Raymond, 40, is a metallurgy graduate of Brooklyn Polytechnic Institute, is married and has two children.

FUNDAMENTALS OF FERROUS METALLURGY

A 15-lesson home study course made up of selected lessons from two M.E.I. courses entitled "Survey of Steel Plant Processes" and "Heat Treatment of Steel". Covers blast furnace, open-hearth, electric furnace, bessemer process, ingot stage, primary rolling mills, flat rolled products, press forging, extrusion, founding, microstructure, austenite transformation, surface hardening, failures and defects. For additional information write to: Dept. RML, Metals Engineering Institute, Novelty, Ohio.

M. E. I. Helps A. S. M. Grow

The Fort Wayne Chapter has had considerable success in getting new members and promoting A.S.M. in the area through M.E.I. courses. The following excerpt of a letter from Dick Hemphill, chairman, tells much of the story:

"We are in agreement with the policy of the National Office that the A.S.M. membership should be increased. It has been our Chapter's goal to reach 100 members, which we have fulfilled this year. It is our opinion that the Metals Engineering Institute should receive credit for this achievement. We are in our second course of Elements of Metallurgy and of the 23 students, 18 are new members. Our present membership has blossomed to 122. Not only has the M.E.I. course aided us in obtaining new members, but has made local industries aware of our Society. As a direct result of this fact, we have also obtained four new sustaining members".

M. E. I.'s Headquarters Staff

Shown Are the Members of the M.E.I. Headquarters Staff at A.S.M. Seated, from left: Barbara Bogdany, who writes letters to prospective students; Mrs. Margaret Johnston, who records enrollments, and assigns student registration numbers; Mrs. Nellee Vese, who fills out student records cards and does general correspondence; Julie Buday, who prepares student files, arranges for shipments and does general correspondence; and Mrs. Phyllis Gillis, secretary to M.E.I.'s director. Standing, from left, are Fred Siegrist, who supervises training programs of half of M.E.I.'s courses; Ralph Lee, who records grades and payments and assists in grading tests; Lew Berger, who supervises remaining half of the courses; John Duzs, who prepares illustrations and letters the certificates; and Anton deS. Brasunas, director of M.E.I.

CHAPTER MEETING CALENDAR

Akron	**Mar. 16**	Sanginiti's Restaurant	**Panel**	Electroplating
Albuquerque	**Mar. 17**		**John Pearson**	Explosive Forming of Metals
Baltimore	**Mar. 21**	Kaiser Aluminum		Plant Visit
Boston	**Mar. 4**	MIT Faculty Club	**W. C. Dunlap**	Metallurgy of Semiconductors
Buffalo	**Mar. 10**	Red Coach Inn		Electrochemistry Related to Metallurgy
Calumet	**Mar. 8**		**R. Leiter**	Galvanized Steel for the Automotive Industry
Chicago	**Mar. 14**	Furniture Club	**Thomas F. Briody**	Metallurgy of Semiconductors
Chicago-Western	**Mar. 21**	Old Spinning Wheel	**W. S. Pellini**	Application of Materials to Thermal and Space Flight Vehicles
Cleveland	**Mar. 7**			Fatigue Failure
Columbus	**Mar. 2**	Desert Inn	**Gordon Carson**	Object Competence
Dayton	**Mar. 9**	Engineers Club	**F. B. Foley**	What Makes Steel Hard
Delaware Valley	**Mar. 16**		**Orlo Lemmer**	Practical Heat Treating
Eastern New York	**Mar. 8**		**V. Zackay**	Geisler Award Lecture
Fort Wayne	**Mar. 14**	Arthur's Chalet	**J. D. Graham**	Field Failures as Influenced By Heat Treatment and Machining
Golden Gate	**Mar. 7**		**C. H. Lorig**	Fruits of Metallurgical Research
Hartford	**Mar. 8**	Indian Hill Country Club	**Panel**	New Developments in Casting
Indianapolis	**Mar. 15**		**Karl L. Fetters**	New Developments in Steelmaking
Jackson, Michigan	**Mar. 15**	Arbor Hills Country Club	**Carl H. Samans**	Stainless Steels for Elevated Temperatures
Kansas City	**Mar 16**	Golden Ox Restaurant	**John A. Fellows**	Ultrasonic Machining
Long Island	**Mar. 16**	Patricia Murphy's	**Clyde S. Hill**	Fabrication Techniques for Honeycomb Construction
Mahoning Valley	**Mar. 8**		**C. B. Dittmar**	Electron Beam Melting
Miami	**Mar. 14**	Woody's Steak House	**W. E. Laesch**	Materials in the Automobile
Milwaukee	**Mar. 15**	City Club	**W. R. Hibbard, Jr.**	Physical Metallurgy in Russia
Montreal	**Mar. 4**	Mount Royal Hotel		Annual Dinner
Muncie	**Mar. 8**		**C. H. Sample**	Corrosion Behavior and Protective Value of Metallic Coatings
New Haven	**Mar. 24**	Waverly Inn	**K. H. Sinason**	Continuous Casting
New Jersey	**Mar. 21**	N.C.E.	**Oscar O. Miller**	Some New Developments in Hardenable Alloy Steels
New York	**Mar. 7**			Missiles
North Texas	**Mar. 3**		**Harry Evans**	Cooling
Oak Ridge	**Mar. 16**	K. of C. Hall	**A. R. Kaufman**	The Metal Beryllium
Ontario	**Mar. 4**	King Edward Hotel		Ladies Night
Penn State	**Mar. 8**	Mineral Industries Auditorium	**Morris Cohen**	
Peoria	**Mar. 14**		**N. O. Kates**	Minimizing Heat Treat Distortion
Philadelphia	**Mar. 25**	Franklin Institute	**D. C. Smith**	Art and Science in the History of Metallography
Phoenix	**Mar. 15**		**M. A Scheil**	Tour
Purdue	**Mar. 15**	Haynes Stellite Co.		Plant Visit
Richmond	**Mar. 8**	Downtown Club	**Karl Aust**	Structure and Properties of Grain Boundaries
Rochester	**Mar. 14**	Manger Seneca Hotel	**H. M. McCullough**	Super-Refractory Alloys
Rockford	**Mar. 23**	Hotel Faust	**Ted C. DuMond**	New Developments in Engineering Materials
Saginaw Valley	**Mar. 8**	High Life Inn	**D. C. Herrschaft**	Research and New Concepts in Brazing
St. Louis	**Mar. 17**		**N. K. Koebel**	New Developments in Atmosphere Heat Treating
Southern Tier	**Mar. 7**		**W. S. Wagner**	Impact Extrusion of Metals
Syracuse	**Mar. 1**	Onondaga Hotel	**F. D. Rosi**	Metallurgy of Semiconductors
Texas	**Mar. 1**		**Howard R. Batchelder**	Atomic Energy
Toledo	**Mar. 10**	Maumee River Yacht Club	**D. H. W. Allan**	Metallurgical Application of Statistical Methods
Tulsa	**Mar. 1**		**Dale L. Hall**	New Processes in Steel Foundry Operations
Washington	**Mar. 21**	All States Restaurant	**John E. Hilliard**	Pressure-Induced Transformation in Metals
West Michigan	**Mar. 21**	Scottie's Restaurant	**M. J. Sinnott**	Metallurgy of Atomic Reactors
Wilmington	**Mar. 9**	Fabian's Restaurant	**W. M. Baldwin Jr.**	Causes of Metal Failures
Worcester	**Mar. 9**	Hickory House	**Panel**	Light Metals
York	**Mar. 9**	Lancaster	**W. B. Sharav**	Submerged Arc Welding

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., Metals Park, Novelty, Ohio, unless otherwise stated.

POSITIONS OPEN

Pacific Northwest

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East

TEACHING-RESEARCH POSITION: Starting July 1, 1960, for recent Ph.D. as assistant professor in metallurgy. Opportunity to teach at junior-senior level and to offer graduate courses. Ample time for research. Prefers research interest in physical metallurgy or physics of metals. Salary open. Reply to: R. W. Lindsay, Dept. of Metallurgy, The Pennsylvania State University, University Park, Pa.

Midwest

ASSISTANT PROFESSOR: Permanent academic position in metallurgical engineering at large university teaching advanced undergraduate, graduate course, and research. Prefer relatively young Ph.D. with interests in physical or chemical metallurgy. Will consider others. Salary dependent upon qualifications. Box 2-90.

METALLURGICAL ENGINEERS: Fansteel's dynamic expansion has created several challenging opportunities with this primary refiner and diverse fabricator of refractory metal products. One assignment is primarily in the area of development of special equipment for processing refractory metals. The other opening is in development work in the technical section of our rolling operations. Send resume in confidence to: Professional Personnel Officer, Fansteel Metallurgical Corp., 2200 Sheridan Rd., North Chicago, Ill.

GRADUATE METALLURGICAL ENGINEER: Steel company desires young man with military training completed who can supervise and conduct research program for development of nonferrous coatings on steel wire. Immediate plans are for development of aluminum coating on steel. Opportunity for advancement into general research program with a long-established and progressive organization. Send complete and detailed description of qualifications, background and salary desired. Box 2-95.

PHYSICAL METALLURGISTS: Opportunity for graduate study toward M.S. or Ph.D. degree while employed as research assistant on fundamental research project in well-equipped modern laboratory at large state university. Applications now accepted from qualified candidates. Box 2-100.

WELDING ENGINEERS: For research and development, to supervise welding development research projects, investigate fabrication welding problems, prepare research reports, supervise assigned welding technicians. Three to five years in welding development work or applied welding engineering necessary. Metallurgical or welding engineering degree required. WELDING ENGINEERS: To work with design engineering and establish weld joint specifications, write procedural specifications, review shop welding practices, appraise investments in welding equipment. Some experience in heavy weldments necessary. Degree required. Write: G. Y. Taylor Administrative Services, Alco Products, Inc., Schenectady 5, N. Y., giving complete resume and salary requirements.

STEEL RESEARCH ENGINEER: To conduct research and development projects in alloy steels in new modern laboratory. Knowledge of laboratory electric steel melting techniques as applied to steel process studies and alloy development essential. At least five years melting practice closely allied with research and development programs required. Advanced degree, preferably Ph.D., desirable but not necessary. Location in Latrobe, Pa. Write, giving resume and salary requirements, to: G. Y. Taylor, Administrative Services, Alco Products, Inc., Schenectady 5, N. Y.

ELECTRO-CHEMIST: Ph.D. preferred, for advanced position in corrosion research. Substantial metallurgical background and experience desired. Send resume in confidence to: J. A. Hill, Research and Development Dept., Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa.

GRADUATE ENGINEER: Minimum of two years in aluminum die casting with experience and interest in development activities. Involves development of new process and improvement of existing processes of metal casting. Will assume responsibility of project in metal casting processes, methods, special equipment and material applications for automotive parts. Experience in tool design and operation desirable. Also, JUNIOR MECHANICAL AND METALLURGICAL ENGINEER: For development of cold forming operations. Degree plus two years of experience. Under 26 years of age. Outstanding benefits and opportunities with expanding, stable organization. Salary commensurate with ability. Apply by resume to: Process Development Staff, General Motors Corp., P. O. Box 128, Detroit 2, Mich.

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POSITIONS WANTED

METALLURGICAL ENGINEER: B.S. degree, age 34, veteran, family. Background includes research on wrought and cast stainless steels and high-temperature alloys and experience as melting supervisor and metallurgist in mechanized iron foundries. Interested in career position utilizing experience. Box 2-5.

METALLURGICAL ENGINEER: M.S., B.S. degrees, age 26, married. Four years experience includes powder metallurgy, heat treatment, rolling, drawing, extrusion, miscellaneous mechanical fabrication with particular emphasis on nuclear fuels and control materials. Proven ability to supervise and lead development and production programs. Seeks position in East with company which can materially recognize technical and administrative ability. "Q" cleared. Box 2-10.

HEAT TREATING FOREMAN OR GENERAL SUPERVISOR: B.S. degree, chemical experience with carbon, low alloy, stainless, pH steels, also aluminum, Inconel, nonferrous alloys, copper and silver brazing, aluminum dip brazing, stainless steel honeycomb structures. Thoroughly experienced in purchase, installation and operation of furnaces (hydrogen, endothermic, exothermic and inert gas atmospheres). Experienced in plating, anodizing and chemical treatments supervision. Knows laboratory procedures for control and development of heat treating and plating processes. Age 50. Available immediately. Minimum $700. Box 2-15.

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METALLURGIST: B.S., M.S. degrees. Desires development or production. Ten years research experience, including supervision on variety of nonferrous metals covering range of basic, applied, production and customer problems with research organizations and primary metal producers. Experience with product development, production control and customer relations, familiar with statistics. Married, children, age 35. Box 2-25.

METALLURGICAL ENGINEER: B.S. degree plus graduate studies; married. Four years experience in development of alloys for high-temperature applications; physical metallurgy of alloy development, melting and fabrication studies and trouble shooting of failed or defective components. Desires responsible position with growth potential in customer contact work or sales engineering. Box 2-35.

SENIOR METALLURGIST: B.S. degree, age 31, married, veteran. Six years experience includes chief metallurgist in heavy forging, welding and specialty steelmaking. Good background in supervision, high-temperature alloys, stainless, toolsteels, aluminum and customer contact work. Extensive advanced studies. Desires challenging position. Box 2-40.

CHEMICAL - METALLURGICAL ENGINEER: Brazilian, married, chemical engineering degree (Brazil), metallurgy degree (U. S.), two years research in analytical chemistry, publications, four years technical director machinery manufacturer, ample experience production, development, technical administration, commercial procedures. Fluent Portuguese, English, German, French. Would change to challenging position with company operating in Brazil. Box 2-45.

METALLURGIST: Young, seeks position overseas. Five-year degree in metallurgical engineering, 1½ years experience in extrusions and drawn tubing. Resume on request. Box 2-50.

CASTING PROCUREMENT SPECIALIST: Age 37, thoroughly experienced in nuclear, missile, commercial fields, ferrous and nonferrous. Fully conversant with Federal QQ, ACI, ASTM specifications, radiography, nondestructive testing, foundry problems. Excellent record in cost reduction and production flow. Will relocate. Desires affiliation with progressive manufacturer. Resume on request. Box 2-55.

METALLURGICAL ENGINEER: B.S., M.S. degrees, with 19 years experience in administration, development, consulting to designers and engineers, technical service and publications. Carbon and alloy steel industry, ferrous and nonferrous metal forming, including forging, extrusion, welding, material and process selection. Fluent knowledge of Russian. Consulting editor leading metals magazine. Seeks new challenge in industry, publications or technical society. Box 2-60.

EXECUTIVE ENGINEER: Chemical engineer, registered metallurgical engineer, with 25 years broad experience in operations management, metallurgical specifications and methods, customer relations and proposals, as well as supervision of plant facility design and construction for specialty metal plants and engineering firms. Excellent job shop knowledge of forging, machining, grinding, heat treatment, welding, quality control, etc. Can deal effectively with and sell ideas to others. Qualified for key line or staff responsibility in operations, engineering or sales. Available Mar. 1. Box 2-65.

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METALLURGICAL ENGINEER: M.S. degree, age 36, with nine years diversified experience in development and materials application in aviation, automotive and electrical industries. Desires supervisory or other responsible position. Minimum $11,000 plus local taxes. Box 2-75.

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Fuel Element Engineering. Responsible for the complete analysis and design of fuel elements. This includes nuclear, thermal, material, mechanical and cost analyses. Should be familiar with fuel life determination methods and reprocessing techniques.

Fuel Fabrication. Activities will include development fabrication of materials and fuel elements, for both plate and rod forms and complex assemblies. A knowledge of non-destructive testing methods is essential, in addition to familiarity with a wide range of material processing and fabrication techniques.

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